International Journal of Exploring Emerging Trends in Engineering (IJEETE)
Vol. 03, Issue 02, Mar-Apr, 2016 Pg. 87 – 93 WWW.IJEETE.COM

A NOVEL APPROACH ON ABANDONED OBJECT DETECTION BASED ON REGION OF INTEREST METHOD

Dr.D.Murugan [1], V.Vivek [2], M.Muthulakshmi [3}
[1]*Associate professor, Dept. of CSE, Manonmaniam Sundaranar University, Tirunelveli.*
[2]*Research Scholar, Dept. of CSE, Manonmaniam Sundaranar University, Tirunelveli.*
[3]*M.E Scholar, Dept. of CSE, Manonmaniam Sundaranar University, Tirunelveli.*

ABSTRACT - *Abandoned object detection is an essential requirement in many video surveillance contexts. This implementation is simple along with reusable unlike existing techniques. Video segmentation is done that converts the input video into number of frames. Objects foreign to a usual environment are extracted using background subtraction. The Region Of Interest (ROI) is extracted, thus eliminating video areas that are unlikely to contain abandoned objects. The process of blob detection computes statistics of the object. Morphological close system is created to fill in small gaps in the detected objects. This paper is used to detect abandoned and stolen objects. The focus is to determine static regions that have recently changed in the prospect by performing background subtraction. The proposed work can detect abandoned objects along with is capable of performing this in real-time and provides more accurate results.*

KEYWORDS :- Object Detection; Video Surveillance; Video Event Detection. Region of Interest (ROI).

1. INTRODUCTION

Abandoned objects are the objects that produce harm to the human beings. The demand for reliable surveillance systems is increasing, especially public areas such as airports, railway and subway stations, sports and event venues. For all this reason, the video surveillance systems that, through the analysis of video sequences, perform automatic detection of security related events or aid human personnel in monitoring a position are gaining increasing interest. An important aspect for current video surveillance systems is the capability of reliably detecting common events such as abandoned or removed object within a scene.

A person leaving a bag behind is a commonly observed situation in public places. It is very useful to identify these situations in time, so that the person responsible can attend to it immediately. There are numerous surveillance cameras already monitoring public areas. Most of these surveillance camera systems are small scale, owned and used by private owners for security purposes, and without any smart surveillance capabilities.

In recent years owing to the ubiquitous presence of cameras, the design of automatic surveillance systems for event recognition in crowded public areas has received much attention. The goal is to equip intelligent systems with the ability to reliably detect the possibility of danger. Here, we tackle the specific threat posed by baggage abandoned in public areas. When a curiously unattended object becomes visible, the operator is likely to review the tape closely to determine how it came to be left there and to ascertain whether it has been abandoned or if its owner has simply stepped away momentarily. If the owner is still there in the scene, there may not be a reason to be concerned, but if he or she cannot be establish, it is certainly a cause for the alarm.

Similarly, in this framework, if a lone object is discovered in the scene, the system tracks it backwards through recent video to look for its owner. The owner of the baggage is assumed to be the individual who brings the object into the scene and sets it down at the location it is found. By inspecting the frames when the object was in contact with a human entity, distinctive features of its candidate owner(s) are acquired. These features are then used to rummage around for the owner in subsequent frames. If no suitable match is found for a predefined period of time, the object is deemed as abandoned and an alarm is raised. If a match is eventually found (i.e. if the owner returns to the suspicious object), the alarm is defused.

In this paper, the abandoned object is detected using the Region Of Interest both in real-time and from recorded video feeds. This video surveillance system is able to detect objects abandoned or removed in both indoor and outdoor environments.

II. RELATED WORK

The abandoned object detector [1] introduced in this paper is able to detect the abandoned object based on the parameters such as blob detection, blob speed, inter blob distance etc. they also discussed about a single use case of NoobaVSS framework, an extensible, open source software package that can be used to introduce smart surveillance capabilities to existing and new surveillance systems, with low cost and processing overhead. In [2], the critical process of parameter estimation is performed by approximating the scale of foreground activities under multiple resolutions. [3] In this paper a new algorithm is described focused on obtaining stationary foreground regions; this is useful for applications like the detection of abandoned or stolen objects and parked vehicles. [4] This paper provides a review of the main background subtraction methods and an original categorization based on speed, memory requirements and accuracy in a principled way.[5] proposes a way to represent an anomaly using a goal driven prolog fact base. In paper [6], this identifies stable intervals of intensity values at every pixel, and determines which interval is most likely to display the true background based on local optical flow information. Lv et al. [7] combine a Kalman filter-based blob tracker with a shape-based human tracker to detect people furthermore objects in motion. Event detection is set up in a Bayesian inference framework. Stauffer and Grimson [8] present an event detection module that classifies objects, including abandoned objects, using a neural network, but is limited to detecting only one abandoned object at a time. The probabilistic tracking model proposed by Smith et al. [9] is built of a mixed state dynamic Bayesian network and a trans-dimensional Markov chain Monte Carlo (MCMC) method. Bhargava et al. [10] characterize the event of object abandonment by its constituent sub-events. Their algorithm verifies the progression of foreground observations by pre-defined event representation and temporal constraints.

Adaptive background subtraction (ABS) has been a rather popular choice to detect unknown, changed or removed articles in the foreground. ABS methods, such as those described in [11,12], build and maintain a statistical model of the background, usually implemented in conjunction with an object tracker. Porikli [13] demonstrates static object detection using long-term and short-term backgrounds constructed using different adaptation rates. Much work has also been done on multi-video surveillance systems [14]. Although such systems have been largely successful, the deployment of multiple cameras per location is usually not practical in wide spread public areas such as the railways.

III. SYSTEM ARCHITECTURE

In this paper background subtraction based technique is selected due to the simplicity of implementation and low processing power. The focus of this paper is on the detection of abandoned objects in public places.The proposed approach is not based on individual tracking of all people and objects; instead, the system only searches for objects left by themselves. In this paper we simply define the stationary object to be an abandoned object that has not been in the scene before.

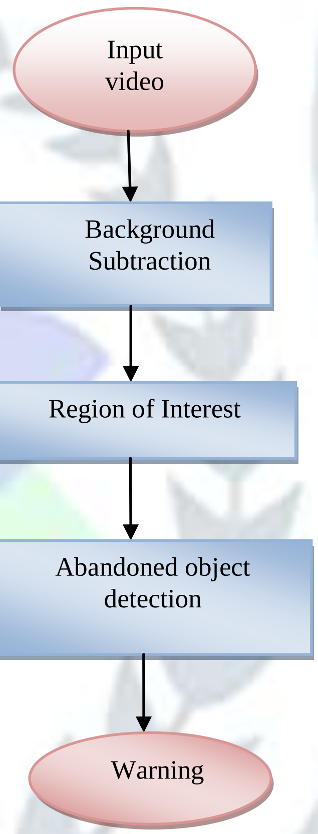

Figure 1: Outline of the proposed work

Our method is designed to capture and exploit the temporal flow of events related to the abandonment of an object. In the proposed algorithm, first Region of interest is selected, and then video is segmented into frames, shots or images for processing background subtraction is performed to detect any new object that may have entered the scene. After that the determination or extraction of foreground image objects are tracked by blob analysis and finally abandoned objects are detected.

Our method involves the following steps:

Step 1: Get input video and select a region of interest (ROI);
Step 2: Perform video segmentation using background subtraction;
Step3: Calculate object statistics using blob analysis;

Step 4: Detect stationary objects based on their area and centroid statistics;

Step 5: Show output video with boundary box around the detected objects.

In the following we describe each step in more detail.

A. Video Segmentation

Video segmentation, the first step in any video data management system is invariably the segmentation of the video track into smaller units. Videos can be segmented such as scenes, images, shots and frames at different levels. Video Segmentation involves modulating the surveillance video for easy processing of video at various levels. In common, Frame is the least of segmentation possible, where each frame contains only the static objects.

In this proposed system frames are taken into consideration for detecting the objects and shots for object detection. First the video is segmented into various forms of scenes, shots and frames. Here the video is modulated as shots. Shots are the set of frames independent of each other. Shot boundaries are detected by comparing the frames that are independent of each other.

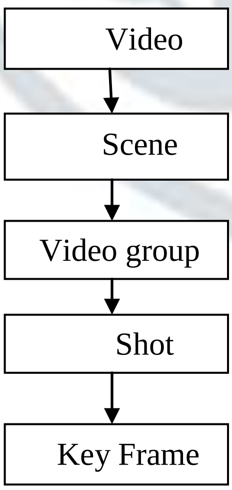

Figure 2: Hierarchy of video segmentation

B. Region Of Interest

Region of interest is defined as maximum number of objects to be track. Region of interest differs from one environment to another environment. For a particular purpose region of interest is a selected as a subset of given dataset, and it provides boundary of number of objects to be track. In this proposed system, the first frame which is captured from camera is taken as the sample to detect the region of interest. The first frame detected is considered as a background subsystem from which individual static objects are detected and stored in the subsystem as region of interest. So, region of interest follows two different phases. First, the system will detect the region of interest from the background system and then store it in a separate subsystem. Based on the region of interest the system performs both the background subtraction and the detection of abandoned object.

C. Store Background Image

This paper uses the first frame of the video as the background. The RGB image frames are converted to YCbCr colour space. Later for the background subtraction operation both intensity and colour information are used. For Blob Analysis it is converted to binary images using auto Threshold Scale Factor.

D. Segmentation Using Background Subtraction

Static background subtraction is used to create a mask for the foreground of an image frame captured from the video feed. As a noise reduction technique, several dilation and erosion operations are done. The resulting mask is then used as an input to identify a set of blobs for each frame. To fill the gaps of the object, morphological closing is performed using neighbouring pixels as the structural element.

The basic method of background subtraction is to compare frame and the background with a pre-defined threshold. If the difference of a pixel is larger than Threshold then classify it as foreground; otherwise, claim that it is background.

Figure 3: Background subtraction

The figure 3 is an example for background subtraction technique.

E. Morphological Operations

Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image, morphological operations rely only on the relative ordering of pixel values, not on their numerical values, and therefore are especially suited to the processing of binary images. Morphological closing operation is performed to fill in small gaps in the detected objects.

Closing - structured filling in of image region boundary pixels, the closing of A by B is obtained by the dilation of A by B, followed by erosion of the resulting structure by B.

$$A \bullet B = (A \oplus B) \ominus B$$

Morphological Close operation is performed to fill in small gaps in the detected objects.

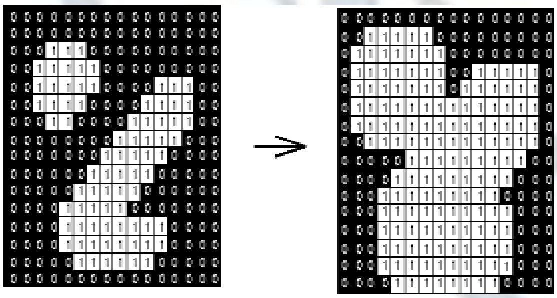

Figure 4: Example of Dilation

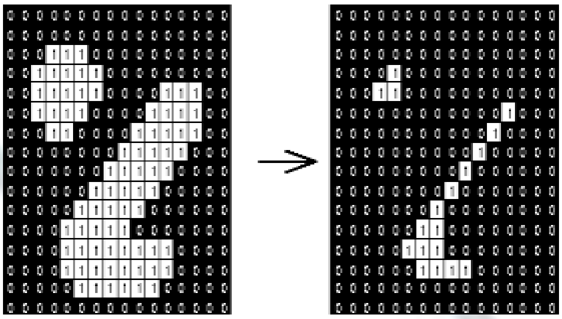

Figure 5: Example of Erosion

F. Blob detection

The Blob Analysis block computes statistics of the objects present in the scene. It computes statistics for labelled regions, including area, centroid, count, maximum number of tracks, and feeds them to the core object detection function subsystem.

IV. SYSTEM DESIGN

The Abandoned Object Tracker subsystem uses the object statistics to determine which objects are stationary. This function gets the count, area, centroid, etc. from the Blob detection, checks whether the area and centroid of the blob has changed less than a ratio, and then determines which objects are stationary.

A. Abandoned object detection

The focus of this paper is on the detection of abandoned baggage in public places. Baggage may include suitcases, sports bags, boxes, etc. The algorithm may be suitably tailored to identify other kinds of objects as well. It is assumed that unattended baggage may be any baggage- like foreground blob that can be seen as distinctly separate one from nearby blobs for at least a short period of time.

Likewise, we define the activity of abandonment of an object in terms of three sub-events: the entry of the owner with the object, departure of the owner without the object, detection of the abandoned object if the owner is not in the scene over a particular period of time. The process is preceded by a basic preprocessing stage that may vary depending on the dataset. To ensure clarity, the algorithm is described in terms of one abandoned object and one rightful owner. It must be noted that the framework

can be extended to handle concurrently multiple abandoned objects and their corresponding owners.

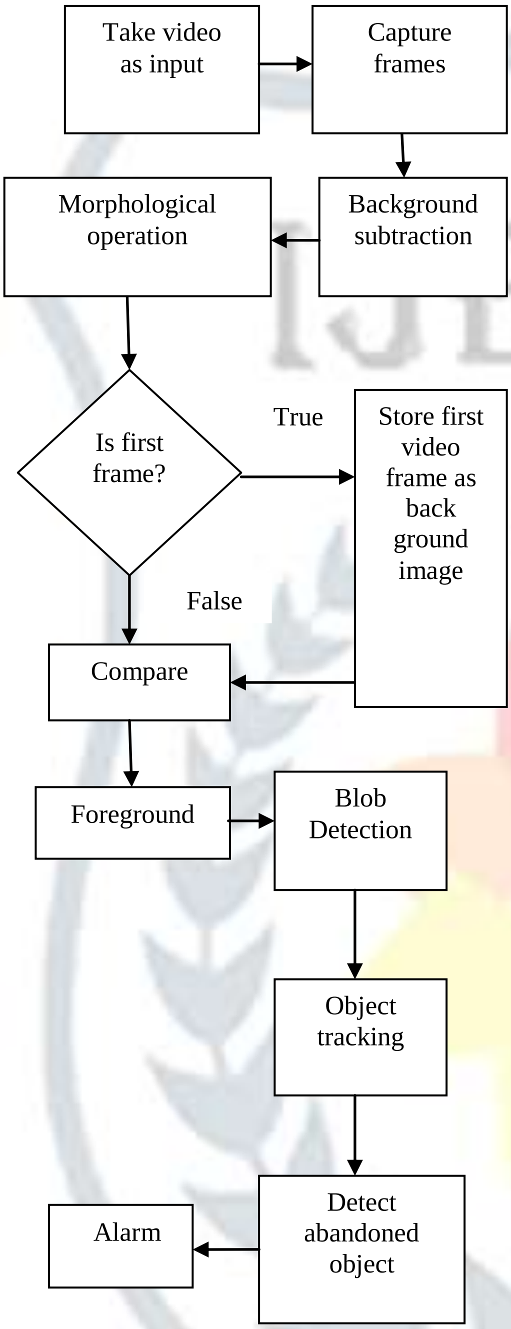

Figure 6: Outline of the proposed work

Object tracking subsystem uses the object statistics to determine which objects are stationary. This function gets the count, area, centroid from the Blob detection, checks whether the area and centroid of the blob has changed less than a ratio, and determines the stationary object.

V. EXPERIMENTAL RESULTS

This paper presents some experimental results. The following figures show an example of detection of an abandoned object in a video.

Figure 7: Person lefts an object

The figure 7 is the abandoned object frame window. In this frame the person lefts an object in the scene.

Figure 8: Abandoned object in the table

The figure 8 shows the abandoned object in the table. After processing in the Abandoned Object frame window, the bag is marked as red which means that this object was not in the first frame.

Figure 9: Location of objects

The figure 9 shows the location of objects in the frame. As soon as the bag was placed and the person left the scene, the window starts showing the bag as green box which means it has subtracted the current frame from the background frame, which is the first frame of the video. The window marks the region of interest (ROI) with the yellow box and the detected object with the green box.

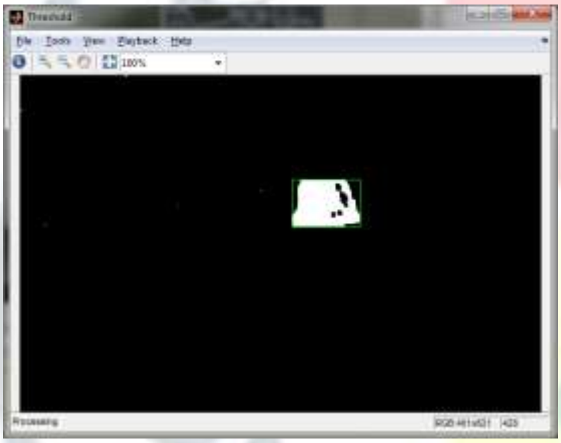

Figure 10: Detected abandoned object

The figure 10 is the Threshold window which shows the result of the background subtraction in the region of interest (ROI) and the abandoned object is detected with a green box around the object. Thus the demonstration of the system is successfully completed.

A. Advantages

- Detecting the abandoned objects is very important to prevent attacks on indoor and outdoor landmarks, public transportation.
- In Automated video surveillance, while monitoring a scene it is able to detect suspicious activities or unlikely events.
- In Traffic Monitoring it is used to detect any vehicle that breaks the traffic rules or is involved in other illegal act.
- Object detection and tracking can also be extended for animation.
- In Vehicle navigation for video-based path planning and obstacle avoidance capabilities.

V. CONCLUSION

Among many research attempts on surveillance video processing, our approach provides a quickly deployable, interactive and user friendly solution to achieve abandoned object detection. In this paper, an abandoned object detection system based on relatively simple operations is implemented and is thus able to run in real-time. The proposed work is also tested for own dataset and the system detects the objects also under low light condition. Our method can handle occlusions in complex environments with crowds. The testing results, which are based on different scenarios, have proved that our approach can be successfully applied in real-world surveillance applications. And we encourage further research on increasing the configurability of video surveillance systems.

VI. REFERENCES

[1] C.Hettiarachchi, Asitha Nanayakkara, Ayesha Dissanayaka, Charith Wijenayake, Chathura De Silva, “Abandoned object detection with logical reasoning” IEEE International Advance Computing Conference (IACC) 2014.

[2] Chen, C.-C., Aggarwal, J.K.: An adaptive background model initialization algorithm with objects moving at different depths. In: IEEE International Conference on Image Processing (ICIP), (2008).

[3] Álvaro Bayona, Juan C. SanMiguel, José M. Martinez, “Stationary foreground detection using background subtraction and temporal difference in video surveillance” 17th IEEE International Conference on Image Processing, ICIP 2010, IEEE 2010.

[4] Massimo Piccardi, "Background Subtraction technique- a review" IEEE International Conference on Systems, Man and Cybernetics,2004.

[5] V. D. Shet, . D. Harwood and L. S. Davis, "VidMAP: Video Monitoring of Activity with Prolog," in IEEE Conference on Advanced Video and Signal Based Surveillance, 2005.

[6] Gutchess, D., Trajkovic, M., Kohen-Solal, E., Lyons, D.,Jain, A.K.: A Background model initialization algorithm for video surveillance. In: Proceedings of IEEE International Conference on Computer Vision (ICCV), pp. 733–740 (2001)

[7] Lv, F., Song, X., Wu, B., Singh, V.K., Nevatia, R.: Left-luggage detection using Bayesian inference. In: Proceedings of IEEE International Workshop on Performance Evaluation of Tracking and Surveillance (PETS), New York, pp. 83–90 (2006)

[8] Stauffer, C., Grimson, W.E.L.: Learning patterns of activity using real-time tracking. IEEE Trans. Pattern Anal. Mach. Intell. (PAMI) **22**(8), 747–757 (2000)

[9] Smith, K., Quelhas, P. Gatica-Perez: Detecting abandoned luggage items in a public space. In: Proceedings of IEEE International Workshop on Performance Evaluation of Tracking and Surveillance (PETS), New York, pp. 75–82 (2006)

[10] Bhargava,M., Chen, C.-C., Ryoo, M.S., Aggarwal, J.K.: Detection of abandoned objects in crowded environments. In: Proceedings of 2007 IEEE International Conference on Advanced Video and Signal based Surveillance (AVSS), London (2007)

[11] Grabner, H., Roth, P., Grabner, M.: Autonomous learning of a robust background model for change detection. In: Proceedings of IEEE International Workshop on Performance Evaluation of Tracking and Surveillance (PETS), New York, pp. 39–54 (2006)

[12] Li, L., Luo, R., Huang, W., Eng, H.: Context-controlled adaptive background subtraction. In: Proceedings of IEEE International Workshop on Performance Evaluation of Tracking and Surveillance (PETS), New York, pp. 31–38 (2006)

[13] Porikli, F: Detection of temporal static regions by processing video at different frame rates. In: Proceedings of IEEE International Conference on Advanced Video and Signal based Surveillance (AVSS), London (2007)

[14] Auvinet, E., Grossmann, E., Rougier, C., Dahmane, M., Meunier, J.: Left-luggage detection using homographies and simple heuristics. In: Proceedings of IEEE International Workshop on Performance Evaluation of Tracking and Surveillance (PETS), New York, pp. 51–58 (2006).

AUTHOR'S BIBLIOGRAPHY

Dr.D.Murugan is an active analyst and researcher in the field of Object Recognition and Intelligent systems; He received his Ph.D. in Computer Science and Engineering. Currently he is working as Associate professor under the Department of Computer Science & Engineering, Manonmaniam Sundaranar University, Tirunelveli, Tamilnadu, India.

V.Vivek, His interest is on the field of real time based applications using digital image processing. He received his Master of Engineering from the Department of Computer Science & Engineering, Manonmaniam Sundaranar University, and currently he is pursuing his Ph.D. at the Centre for Research, Manonmaniam Sundaranar University, Tirunelveli, Tamilnadu, India.

M.Muthulakshmi, Her interest is on the field of image processing. She graduated B.E in Computer Science & Engineering from Anna University, Ariyalur campus. Currently she is pursuing her Master of Engineering from Department of Computer Science & Engineering, in Manonmaniam Sundaranar University, Tirunelveli, Tamilnadu, India.